

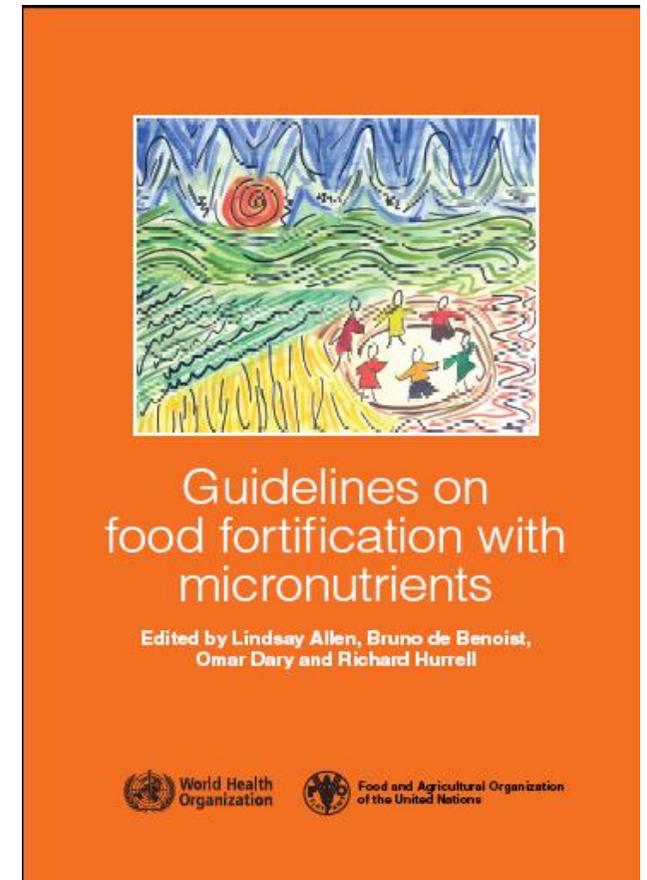


Introduction to WHO Recommendations on Wheat and Maize Flour Fortification

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WHO FAO Guidelines on Food Fortification with Micronutrients

- Resource for governments and agencies implementing or considering food fortification
- Source of information for scientists, technologists and the food industry.
- General principles for effective fortification programs



Flour Fortification with Micronutrients



- Fortification of staple foods (i.e. wheat flour) can improve the nutritional status of a large proportion of the population,
 - Requires no changes in dietary patterns
 - Requires no individual decision for compliance
- Worldwide, over 600 million metric tons of wheat and maize flours are milled annually by commercial roller mills
- When appropriately implemented, is effective, simple, and inexpensive strategy for supplying vitamins and minerals to the diets



Statement Development Process

- Statement prepared by the core group led by
 - WHO's Department of Nutrition for Health and Development in close collaboration with partners
 - The core group evaluated the commissioned scientific reviews prepared by expert working groups for FFI Technical Meeting
 - Approved by WHO Guideline Review Committee in interim period year 2008
 - These recommendations remain valid until December 2010
 - WHO headquarters in Geneva will initiate a review following formal *WHO Handbook for Guideline Development* procedures in 2010

WHO Recommendations

- Provides guidance on national fortification of wheat and maize flours
- Milled in industrial roller mills (i.e. ≥ 20 metric tons (MT)/day milling capacity)
- Focuses on key nutrients
 - iron
 - folic acid
 - zinc
 - vitamin B₁₂
 - vitamin A

Wheat and Maize Flour Fortification

- Improve iron status among consumers if a sufficient level of bio-available forms of iron is added
- Increase folic acid intake by women and reduces NTDs (folic acid may also have additional public health benefits)
- Could be a feasible approach to improve vitamin B12 status of populations
- Can increase vitamin A intake and improve status
- Improve zinc status among consumers if a sufficient level of zinc is added

Considerations for determining levels of vitamins and minerals to add to flour

- Estimate the per capita consumption of nationally produced and imported flour milled by industrial roller mills
- Avoid risk of human exposure to excess levels of vitamins and minerals caused by very high consumption of fortified flour products.
- Consider potential sensory and physical effects of added nutrients on flour and flour products.
- Understand that there is much less experience in fortifying maize flours than wheat flours.
- Consider the cost implications of the fortificant premix formulation.

Four Levels of Flour Consumption

- Based on distribution of per capita flour consumption across a number of countries using
 - Food Balance Sheet data from the Food and Agriculture Organization (FAO)
 - World Bank supported Household Income and Expenditure Survey (HIES)

Estimated percentile distributions of per capita wheat flour availability (g/day) from the Household Income Expenditure Surveys for countries stratified by ranges of per capita wheat flour availability

Percentile of Wheat Flour Availability	Ranges of Daily Per Capita Availability of Wheat Flour (g/day)			
	<75	75-149	150-300	>300 ¹
5 th	7.5	15	30	60
50 th	50	100	200	400
95 th	150	300	600	800

Few countries have per capita consumption of >300 grams per day. 1

Recommendations on Wheat and Maize Flour Fortification

Meeting Report: Interim Consensus Statement

<http://www.who.int/nutrition/>

Available in UN languages

- *English*
- *Russian*
- *Chinese*
- *Spanish*
- *French*
- *Arabic*

Suggested citation

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World Health
Organization

Recommendations on Wheat and Maize Flour Fortification
Meeting Report: Interim Consensus Statement

PURPOSE

This statement is based on scientific reviews prepared for a Flour Fortification Initiative (FFI) technical workshop held in Stone Mountain, GA, USA in 2008 where various organizations actively engaged in the prevention and control of vitamin and mineral deficiencies and various other relevant stakeholders met and discussed specific practical recommendations to guide flour fortification efforts being implemented in various countries by the public, private and civic sectors. This joint statement reflects the position of the World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), The United Nations Children's Fund (UNICEF), Global Alliance for Improved Nutrition (GAIN), The Micronutrient Initiative (MI) and FFI. It is intended for a wide audience including food industry, scientists and governments involved in the design and implementation of flour fortification programs as public health interventions.

BACKGROUND

WHO and FAO published in 2006 the *Guidelines on Food Fortification with Micronutrients* (WHO/FAO, 2006). These general guidelines, written from a nutrition and public health perspective are a resource for governments and agencies implementing or considering food fortification and a source of information for scientists, technologists and the food industry. Some basic principles for effective fortification programs along with fortificants physical characteristics, selection and use with specific food vehicles are described. Fortification of widely distributed and consumed foods has the potential to improve the nutritional status of a large proportion of the population, and neither requires changes in dietary patterns nor individual decision for compliance. Technological issues to food fortification need to be fully resolved especially with regards to appropriate levels of nutrients, stability of fortificant, nutrient interactions, physical properties and acceptability by consumers (WHO/FAO, 2006). Worldwide, more than 600 million metric tons of wheat and maize flours are milled annually by commercial roller mills and consumed as noodles, breads, pasta, and other flour products by people in many countries. Fortification of industrially processed wheat and maize flour, when appropriately implemented, is an effective, simple, and inexpensive strategy for supplying vitamins and minerals to the diets of large segments of the world's population. It is estimated that the proportion of industrial-scale wheat flour being fortified is 97% in the Americas, 37% in Africa, 48% in Eastern Mediterranean, 27% in South-East Asia, 6% in Europe, and 4% in the Western Pacific regions in 2007 (FFI, 2008).

THE FFI SECOND TECHNICAL WORKSHOP ON WHEAT FLOUR FORTIFICATION

Nearly 100 leading nutrition, pharmaceutical and cereal scientists and milling experts from the public and private sectors from around the world met on March 28 to April 3, 2008 in Stone Mountain, GA, USA to provide advice for countries considering national wheat and/or maize flour fortification. This *Second Technical Workshop on Wheat Flour Fortification: Practical Recommendations for National Application* was a follow up to a FFI, the US Centers for Disease Control and Prevention (CDC) and the Mexican Institute of Public Health, first technical workshop entitled "Wheat Flour Fortification: Current Knowledge and Practical Applications," held in Guanajuato, Mexico in December 2004 (FFI, 2004). The purpose of this second workshop was to provide guidance on national fortification of wheat and maize flours, milled in industrial roller mills (i.e. >20 metric tons/day milling capacity), with iron, zinc, folic acid, vitamin B₉ and vitamin A and to develop guidelines on formulations of premix based on common ranges of flour consumption. A secondary aim was to agree on the best practices guidelines for premix manufacturers and millers. Expert work groups prepared technical documents reviewing published efficacy and effectiveness studies as well as the form and levels of fortificants currently being added to flour in different countries. The full reviews will be published in a supplement of *Food and Nutrition Bulletin* in 2009 and the summary recommendations of this meeting can be found in <http://www.aph.emory.edu/wheatflour/atlanta08/> (FFI, 2008).

RECOMMENDATIONS FOR WHEAT AND MAIZE FLOUR FORTIFICATION

Wheat and maize flour fortification is a preventive food-based approach to improve micronutrient status of populations over time that can be integrated with other interventions in the efforts to reduce vitamin and mineral deficiencies when identified as public health problems. However, fortification of other appropriate food vehicles with the same and/or other nutrients should also be considered where feasible. Wheat and maize flour fortification should be considered when industrially produced flour is regularly consumed by large population groups in a country. Wheat and maize flour fortification programmes could be expected to be most effective in achieving a public health impact if mandated at the national level and coordinated with international public health goals. Decisions about which nutrients to add and the appropriate amounts to add to fortify flour should be based on a series of factors including the nutritional needs and deficiencies of the population, the usual consumption profile of "fortifiable" flour (i.e. the total estimated amount of flour milled by



World Health
Organization

Micronutrients Unit

Recommendations on Wheat and Maize Flour Fortification

Meeting Report: Interim Consensus Statement

This joint statement reflects the position of:

- World Health Organization (WHO)
- Food and Agriculture Organization of the United Nations (FAO)
- The United Nations Children's Fund (UNICEF)
- Global Alliance for Improved Nutrition (GAIN)
- The Micronutrient Initiative (MI) and
- Flour Fortification Initiative (above+ other partners)



Recommendations on Wheat and Maize Flour Fortification Meeting Report: Interim Consensus Statement

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Wheat and maize flour fortification

- Is a preventive food-based approach to improve micronutrient status of populations over time
- Can be integrated with other interventions in the efforts to reduce vitamin and mineral deficiencies
- Should be considered when industrially produced flour is regularly consumed by large population groups
- Most effective if mandated at the national level

Nutrients to add: decisions

- Nutritional needs and deficiencies of the population
- Usual consumption profile of “fortifiable” flour
- Sensory and physical effects of the fortificant nutrients on flour and flour products
- Fortification of other food vehicles
- Consumption of vitamin and mineral supplements
- Costs

Flour Fortification Programs

- Should include appropriate Quality Assurance and Quality Control (QA/QC) systems at mills
- Regulatory and public health monitoring of the nutrient content of fortified foods
- Assessment of the nutritional/health impacts of the fortification strategies.

Average levels of some nutrients to consider adding to fortified wheat flour



Nutrient	Flour Extraction Rate	Compound	Level of nutrient to be added in parts per million (ppm) by estimated average per capita wheat flour availability (g/day) ¹			
			<75 ² g/day	75-149 g/day	150-300 g/day	>300 g/day
Iron	Low	NaFeEDTA	40	40	20	15
		Ferrous Sulfate	60	60	30	20
		Ferrous Fumarate	60	60	30	20
		Electrolytic Iron	NR ³	NR ³	60	40
	High	NaFeEDTA	40	40	20	15
Folic Acid	Low or High	Folic Acid	5.0	2.6	1.3	1.0
Vitamin B ₁₂	Low or High	Cyanocobalamin	0.04	0.02	0.01	0.008
Vitamin A	Low or High	Vitamin A Palmitate	5.9	3	1.5	1
Zinc ³	Low	Zinc Oxide	95	55	40	30
	High	Zinc Oxide	100	100	80	70

*based on extraction, fortificant compound, and estimated per capita flour availability

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The Micronutrient Initiative (MI)

The Global Alliance for Improved Nutrition (GAIN)

Flour Fortification Initiative (FFI)